QCD Status and Plans
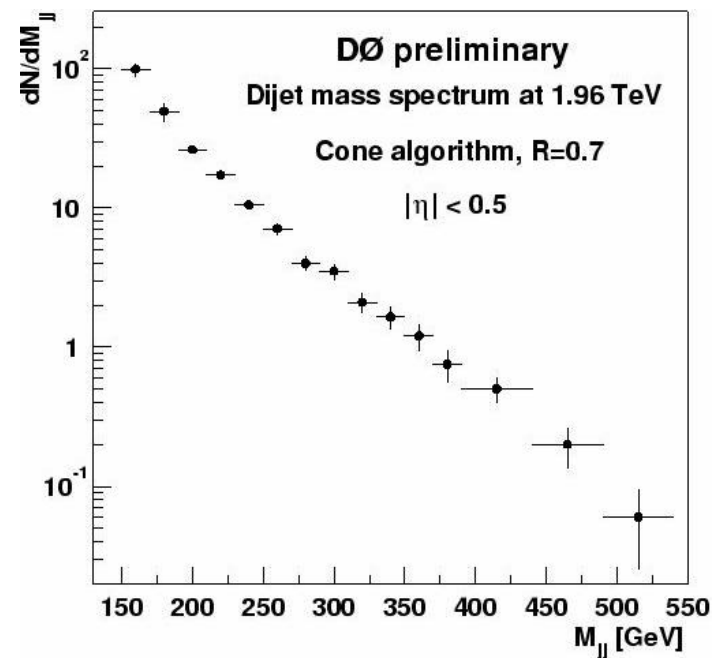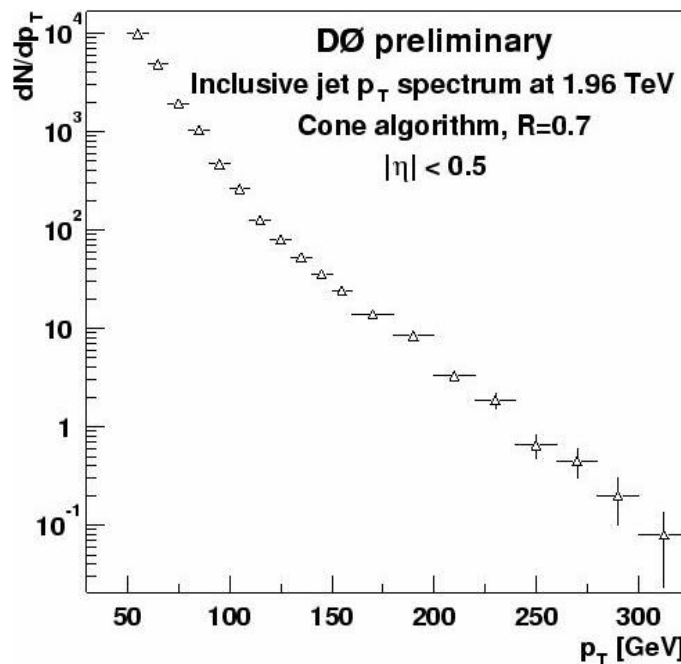# for the rest of 2002

John Krane

Iowa State University

- Jets, photons, diffraction
- Jet algorithm
- Triggers
- Starting the clock

QCD Physics: Jets

- Inclusive xsec / dijet mass
 A. Kupco, G. Davis, M. Zielinski, me

QCD Physics: Jets

- Compositeness/high-mass   Don Lincoln

- Dijet angular   V. O'Dell

- 1 jet $\eta_1=0$, 1 jet $\eta_2=x$??? Demo for ICHEP

- Many other analyses

  Triple differential, event shapes for 3 jets,
 4 jets, k_T jet xsec and thrust

QCD Physics: Photons

- Inclusive isolated xsec Nikolai Skatchkov, Dmitry Bandurin
  - Needs effic., purity estimates
  - Continually optimizing ID with MC and data

- Preshower info will
  change the optimization

- Using CEM15, EM_HI

- Other analyses available
  Photon-jet angular, diphoton xsec and
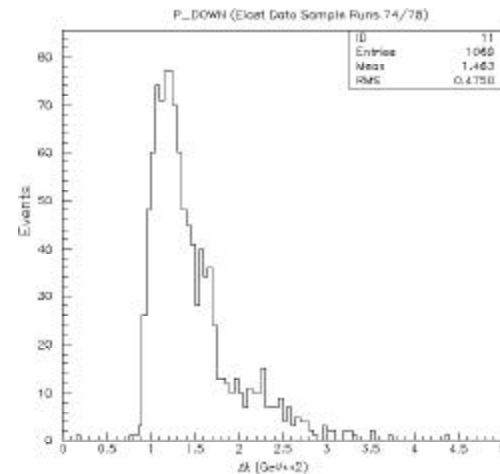 angular, $\gamma jj/\gamma j$
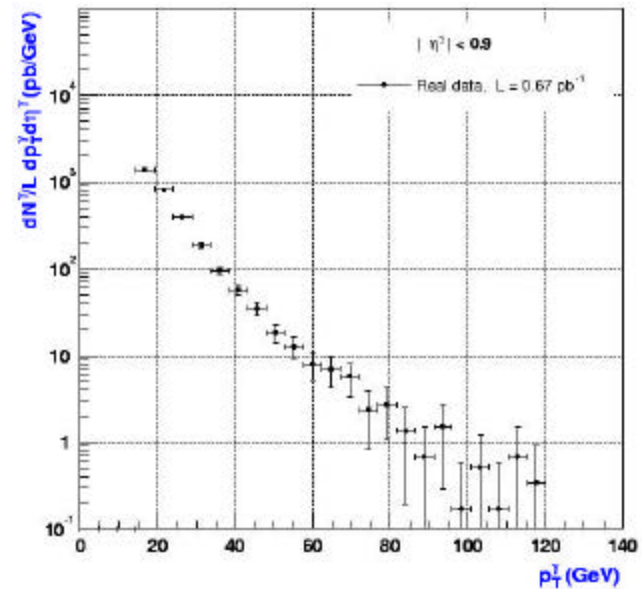
QCD Physics: Diffraction

- Elastic xsec
  Jorge Molina

- Single diff xsec
  Mike Strang

- Preliminary alignment complete

- Roman Pots go in almost every store. DAQ integration continues.

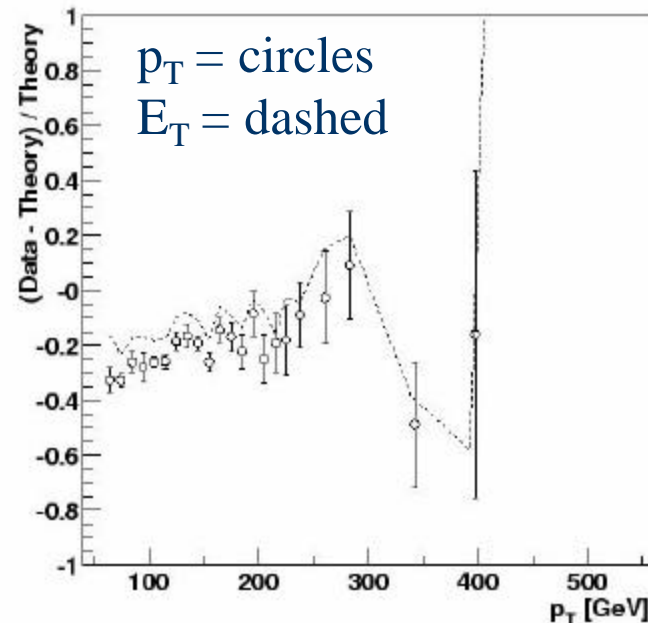- Gap triggers submitted today
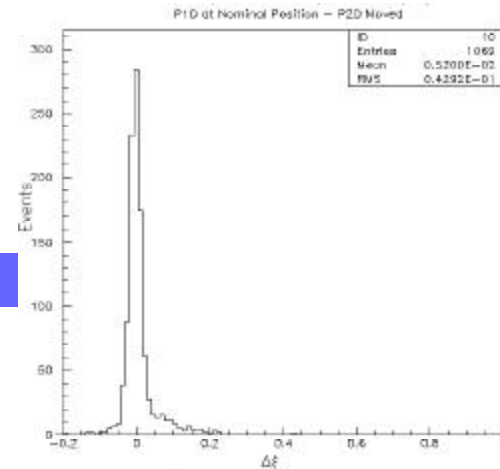
ξ distribution

t distribution

Jet algorithm work

p_T = circles
E_T = dashed

Jet algos …

CDF/DØ/Theory Workshops

- Using p_T not E_T ~10% difference in xsec

- 4-vector summation, no more "Snowmass angles"

- Midpoint seeds chosen with 4-vector sum, not p_T-weighted ave

Yes these are just details, but we want them to match!

Unclustered event energy
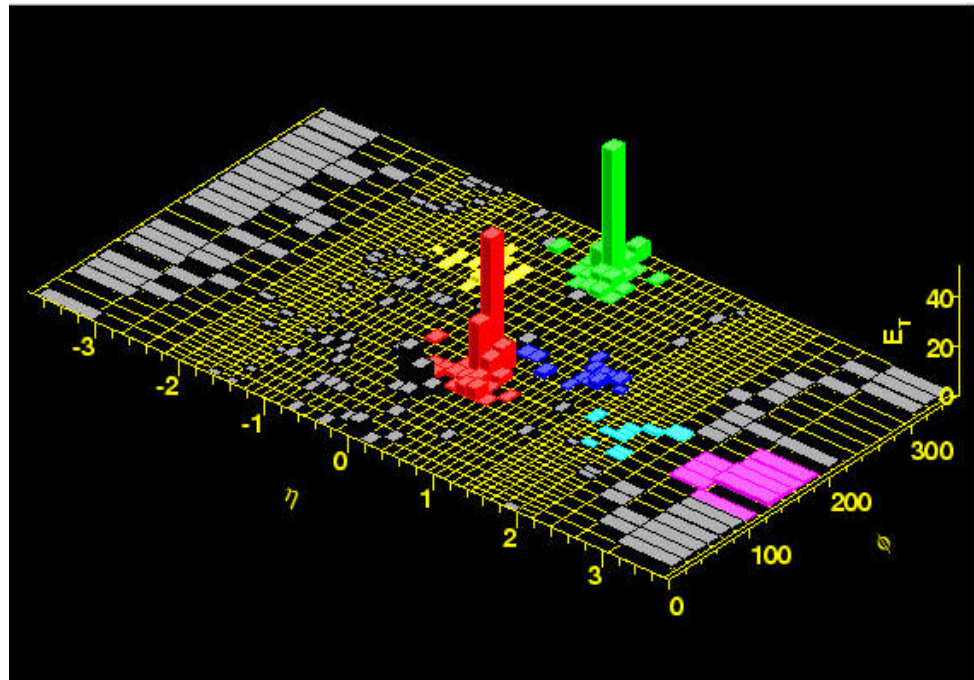
- CDF:

  Matthais Toennesmann

- DØ:

  Vishnu Zutshi, me

Cones can iteratate
away from "small"
Energy clusters

- The Run I algorithm did this too...

Lost energy: probably not a big deal

Estimated <1% effect…but CDF keeps using **JetClu**

Suggested procedure: $R_{search}=R/Sqrt(2)$ or $R/2$

- use a smaller iterative cone, then enlarge
  (small cones less likely to get "lured" away)
- use full-size iterative midpoint cone

You might find the energy as one or two jets, but you should find all the energy

JetID/QCD will probably recommend changing JCCA, JCCB

QCD L1 Jet Triggers

- Early triggers: single-towers with large E_T required
  - For instance, (1,5), (1,15), or (1,40)
  - Efficiency vs. E_T was dismal for high E_T
  - Noise rejection was lousy for low E_T

- Current triggers: multi-towers with small E_T required
  - E.g., (2,5) or (4,5)
  - Excellent noise rejection (as we learned in Run I)
  - Turn-on still poor for high E_T
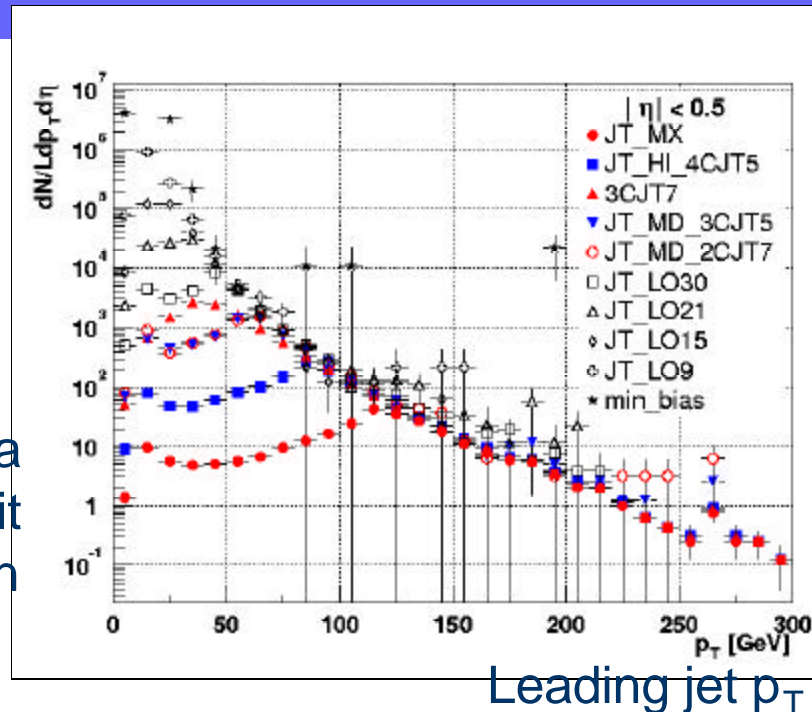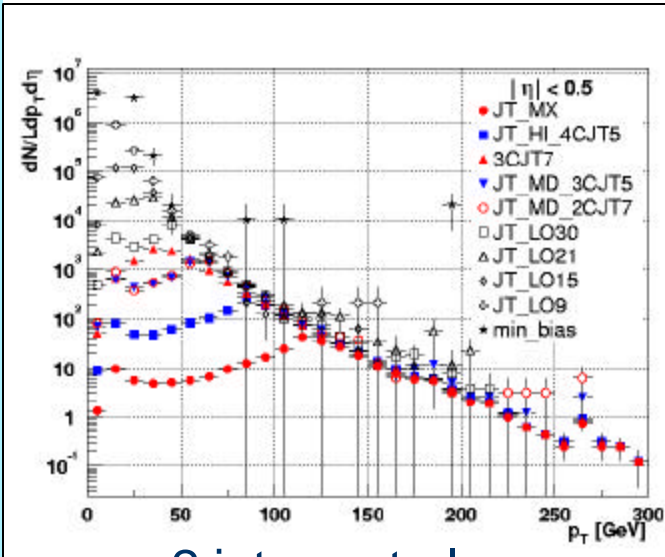
The dijet cross section by L1 trigger

Consider (3,7) ▲

It does not become
efficient until 100 GeV

Jets span more than just a
few towers, and deposit
energy very unevenly in
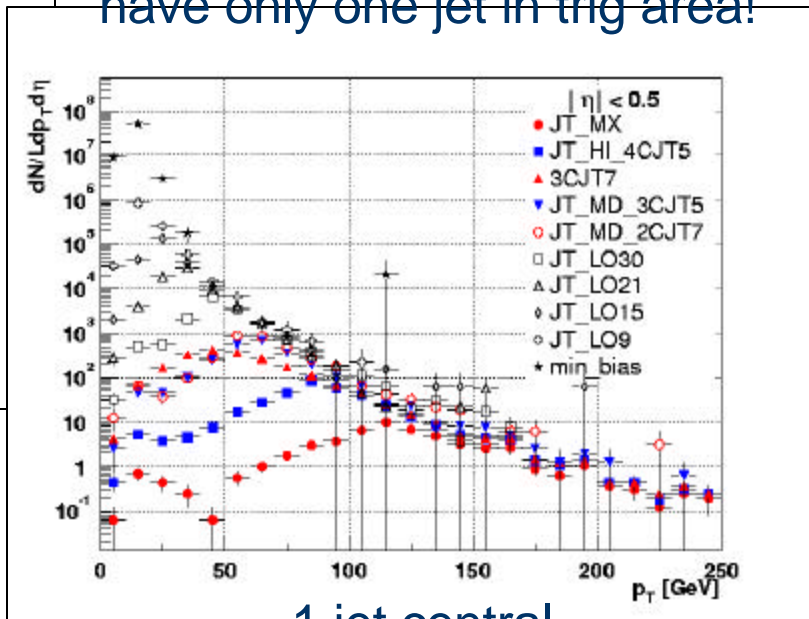those towers
-- slow turn on

Leading jet p_T

but wait, it gets worse!

2 jets central

Very different efficiency if you have only one jet in trig area!

1 jet central

The show must go on...

QCD L3 Jet Triggers

$\varepsilon = 1$
L1
L3
E_T
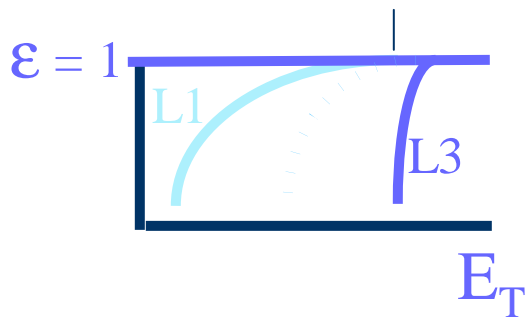
L1 TT	L3 Jet
2,3	25 Gev
2,5	45 Gev
3,5	65 Gev
4,5	95 Gev
4,7	125 Gev

- Find the $\varepsilon = 1$ point for L1 term
  For 2 jets…not quite for 1 jet case

- Select an L3 threshold there

- Aggressive rejection (x50) at L3

L3 input can only take so much!

Sure, we vastly increased the useful jets to tape,
but now we want the physics data set. (Not another temporary set.)

Three ways to fix QCD triggers

- Full η coverage   …June 1 η=1.6, June 17 for η=2.4
  Make all jet events into 2-jets in region events
  (Other groups still won't like these triggers)

- Large Tiles   …means a schedule change
  Single large tiles turn on quickly
  No need for multiple tile triggers,
        remove multi-tower triggers

- Level 2 to the rescue? May?
  Single-tower triggers w/low threshold flood L2…let L2 be our large tiles

                    We want L2markpass
                    as soon as possible!

Do we really need to wait for months?

The goal: publish an early set of results

Many QCD measurements do not need

enormous $\int L\, dt$

optimal mass resolution

full tracking, muons

Jet data still not perfect but would probably be repairable offline

full η coverage in trigger

Selections from CDF's QCD history in Run I

1988-1989 data

1992: 4.2 pb^{-1} inclusive jet, 3jet, (photon), Large H$_T$, dijet ang.

1993: 4.2 pb^{-1} 546/1800, dijet mass+search, diphoton, 4jet, inclusive photon, diphoton ang.

1992-1993 data

1994: 19 pb^{-1} incl. Photon

1996: 19 pb^{-1} incl. Jet, 106 pb^{-1} dijet ang.

Forward!

Set quality goals

final algo
sca non-linearity fix (p11?)
dedicated lum w/errors

statistics goals

Not nec. 500 pb^{-1}

➢ We would like to "start the clock" on
      unbiased jet data   *we can't fix the data*
                                       we fail to collect

10% effic correction - maybe. 100%? Forget it!

QCD in 2002

- Jet, photon, and diffractive physics all advancing, with a good trigger, we could have physics!

- Remote analysis cluster at JINR will speed photon work

- FPD is producing data, Proton ID group in place, gap triggers proposed

- The QCD group features ROOM for YOU